# PROJECT SCHEDULING

## 2016 DESIGN EXPO

# Objectives

- Learn why schedules are needed

- Examples of various schedule templates

- Explore major components of a schedule

- Indentify the critical path

- Schedule updating

- Lessons learned

# Why Are Schedules Needed?

▶ Provide a **plan** for **what** tasks are required and **when** those tasks should start and finish

▶ Live & dynamic – Schedules record progress **and** reassess remaining work based on that progress

▶ Assists in recognizing and addressing factors potentially affecting project performance

▶ Ability to forecast gains or shortfalls in a project's progress

# Schedule Templates

► Schedule templates are created by the Program Services Office in conjunction with area experts

► Schedule templates are developed to outline the process required for a particular phase <u>or</u> type of work, examples:

► 3R / Resurfacing

► Bridge Repair

► Bridge Replacement

► Sidewalks

► Landscaping

► Capacity

➢ Right of Way Acquisition

➢ PD&E Studies

➢ Design Build Low Bid

➢ Design Build Adjusted Score

# Major Components of a Schedule

- Activity ID
- Activity Name
- Original Duration

- Start Dates
- Finish Dates
- Total Float

| Activity ID | Activity Name | Original Duration | Start | Finish | Late Start | Late Finish | Total Float |
|---|---|---|---|---|---|---|---|
| **428710-1  SR 5 (US 17) FROM DUVAL  C/L TO I-95** | | | | | | | |
| **County: Nassau** | | | | | | | |
| **Work Mix: Resurfacing** | | | | | | | |
| 11302000 | Prepare PH II Plans | 40 | 05-Feb-13 A | 03-Apr-13 | 10-Apr-13 | 11-Apr-13 | 6 |
| 27101000 | Request Geotechnical Information | 1 | 02-Apr-13 | 02-Apr-13 | 11-Apr-13 | 11-Apr-13 | 7 |
| 90202000 | SUBMIT PH II PLANS | 1 | 04-Apr-13 | 04-Apr-13 | 12-Apr-13 | 12-Apr-13 | 6 |
| 28501000 | PH.57 Railroad Encumbered | 1 | 15-Apr-13* | 15-Apr-13 | 15-Apr-13 | 15-Apr-13 | 0 |
| 19903000 | Update LRE Quantities - PH II | 5 | 02-Apr-13 | 08-Apr-13 | 17-Jul-13 | 23-Jul-13 | 76 |

# Activity ID

- The numbers used for the activity ID are based on a statewide standard list (where possible)
    - For example, AE 280 = Letting Date

- Enables clear communication statewide and within the district

# Activity Name

► Activities encompass the major tasks required to complete a project.  For example:

  ► Prepare Phase II Plans

  ► Utility Coordination I

  ► Permit Submittal

  ► Letting Date

► Generally, only major tasks and milestones are included in the project schedules

# Durations

► Original Duration is the estimated amount of time it takes to start and finish a particular activity

► Based on a 5 day workweek (except for Construction)

   ► For example, the original duration for AE 11302000 Prepare Phase II Plans is 40 days (roughly 2 months)

# Start & Finish Dates

- Early Start / Finish
  - The earliest date an activity can start or finish
- Late Start / Finish
  - The latest date an activity can start or finish <u>without negatively impacting</u> a schedule constraint or project end date
- Actual Start / Finish
  - The actual date work began or ended on an activity; must be a past date
  - Denoted by the letter "A" in the schedule (05-Feb-13A)

# Example Dates

| Activity ID | Activity Name | Original Duration | Start | Finish | Late Start | Late Finish | Total Float |
|---|---|---|---|---|---|---|---|
| 25001000 | Begin Work | 1 | 01-Jul-13 A | 01-Jul-13 A | | | |
| 23201000 | PH 32 Consultant Acquisition | 130 | 02-Jul-13 | 30-Dec-13 | 12-Aug-13 | 07-Feb-14 | 29 |
| 23301000 | PH 32 Contract Executed | 1 | 10-Feb-14 | 10-Feb-14* | 10-Feb-14 | 10-Feb-14 | 0 |
| 23401000 | NTP | 1 | 11-Feb-14 | 11-Feb-14 | 11-Feb-14 | 11-Feb-14 | 0 |

- The actual finish date for "Begin Work" is July 1, 2013

- The <u>earliest</u> start for "Consultant Acquisition" is July 2, 2013
    - Based on the predecessor finishing on July 1st, this activity <u>could</u> start as early as July 2nd.

- The <u>latest</u> start for "Consultant Acquisition" is August 12, 2013
    - Anything later than this date will negatively impact the contract execution which has been set for February 10th.

# What is Total Float?

▶ Total float is the amount of time an activity can be delayed without impacting a constraint or the finish of the project (usually the letting date)

▶ Calculated as the difference between the late & early dates of the activity

- ▶ Total float greater than 0 indicates schedule activities could be delayed without negatively impacting the project end date (Positive Float)

- ▶ Total float less than 0 indicates that a project is behind schedule and the constraint or finish date is negatively impacted

   (Negative Float)

- ▶ Total float equal to 0 indicates that a project's early and late dates are the same and cannot be delayed (Zero Float)

# Positive Float

- Positive float indicates that an activity is ahead of schedule and <u>could</u> be delayed, if needed

  - *R/W certification can occur no later than 06/28/13 (late start) to make a 07/01/13 Plans to Specifications date. However, certification is scheduled to occur on 06/24/13 (early start), which is 4 workdays ahead of schedule*

## R/W Certified

Duration = 1 day

Early Start = 06/24/13

Late Start = 06/28/13

Total float = 4 days

## Plans to Specs

Duration = 1 day

Must finish by 07/01/13

Early Start = 07/01/13

Late Start = 07/01/13

Total float = 0 days

# Negative Float

▶ Negative float indicates that an activity is behind schedule

    ▶ *R/W certification can occur no later than 06/28/13 (late start)to make a 07/01/13 Plans to Specifications Date.  However, R/W Certification is scheduled to occur on 07/05/13, which is 5 workdays behind schedule*

## R/W Certified

Duration = 1 day

Early Start = 07/05/13

Late Start = 06/28/13

Total float = -5 days

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## Plans to Specs

Duration = 1 day

Must finish by 07/01/13

Early Start = 07/01/13

Late Start = 07/01/13

Total float = 0 days

# Zero Float

- Zero float indicates that an activity's early & late dates are the same

  - *R/W certification can occur no later than 06/28/13 to make a 07/01/13 Plans to Specifications Date. R/W Certification is scheduled to occur on the latest date possible, 06/28/13 (0 days float).*

## R/W Certified

Duration = 1 day

Early Start = 06/28/13

Late Start = 06/28/13

Total float = 0 days

## Plans to Specs

Duration = 1 day

Must finish by 07/01/13

Early Start = 07/01/13

Late Start = 07/01/13

Total float = 0 days

# Logic

► In order for a schedule to be dynamic, logic is implemented to show the **relationships** between activities within a schedule

  ► Predecessors are activities that occur <u>before</u> a particular activity

  ► Successors are activities that occur <u>after</u> a particular activity

► Allows the schedule to adjust in response to activity progress

# Example Logic

Predecessor

**Prepare Ph I Plans**
Start = 07/01/2013
Finish = 08/01/2013
Float = 0

→

**Submit Ph I Plans**
Start = 08/02/13
Finish = 08/02/13
Float = 0

→

Successor

**Review Ph I Plans**
Start = 08/03/13
Finish = 08/22/13
Float = 0
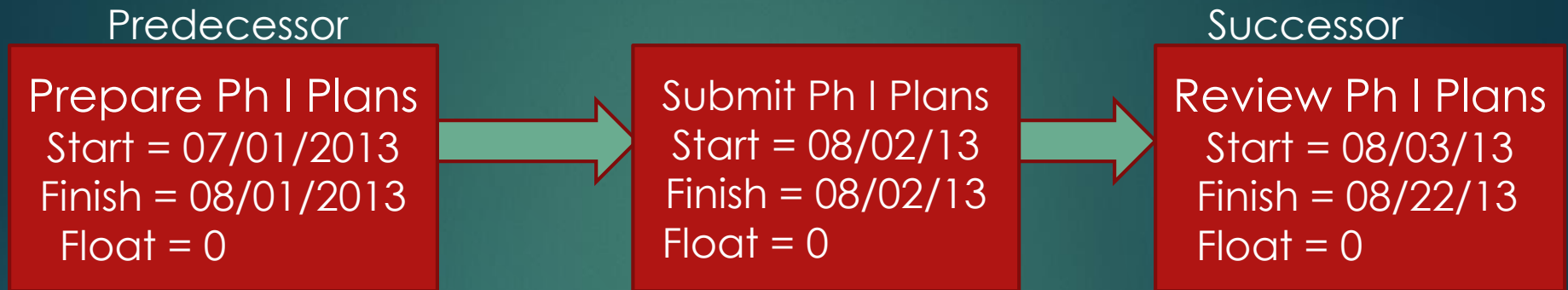
- Activity "Prepare Phase I Plans" is a <u>predecessor</u> for "Submit Phase I Plans"
  - *Phase I Plans must be prepared before they can be submitted*
- Activity "Review Phase I Plans" is a <u>successor</u> for "Submit Phase I Plans"
  - *Phase I Plans must be submitted before they can be reviewed*

# Example Logic

| Predecessor | | Successor |
|---|---|---|
| Prepare Ph I Plans<br>Start = 08/01/2013<br>Finish = 09/01/2013<br>Float = -21 days | Submit Ph I Plans<br>Start = 09/02/13<br>Finish = 09/02/13<br>Float = -21 days | Review Ph I Plans<br>Start = 09/03/13<br>Finish = 09/22/13<br>Float = - 21 days |
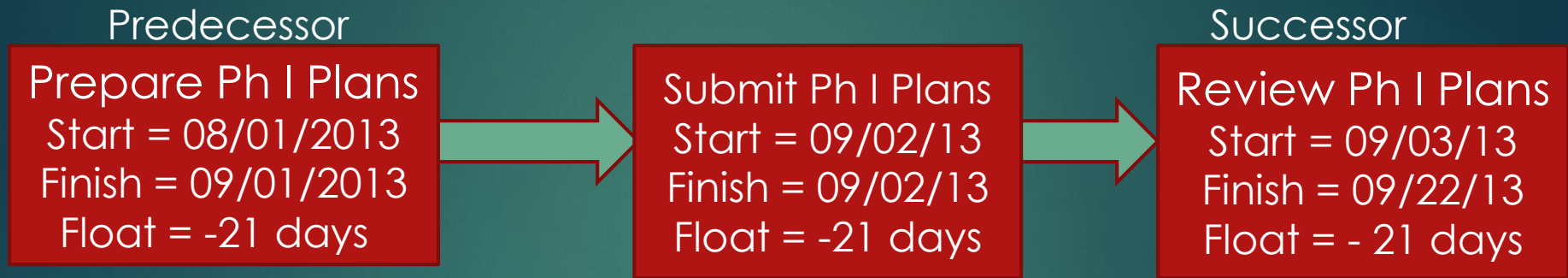
▶ Since these activities are "tied" together logically, any gain <u>or</u> delay affects other activities in this path

  ▶ *For example, if Prep Ph I Plans didn't actually start until 09/01/13 (1 month later than originally scheduled), all dates in the path would also be delayed in response*

▶ For this reason, it is important to keep activities on schedule since delays affect others in the same path

# 3R Logic Template
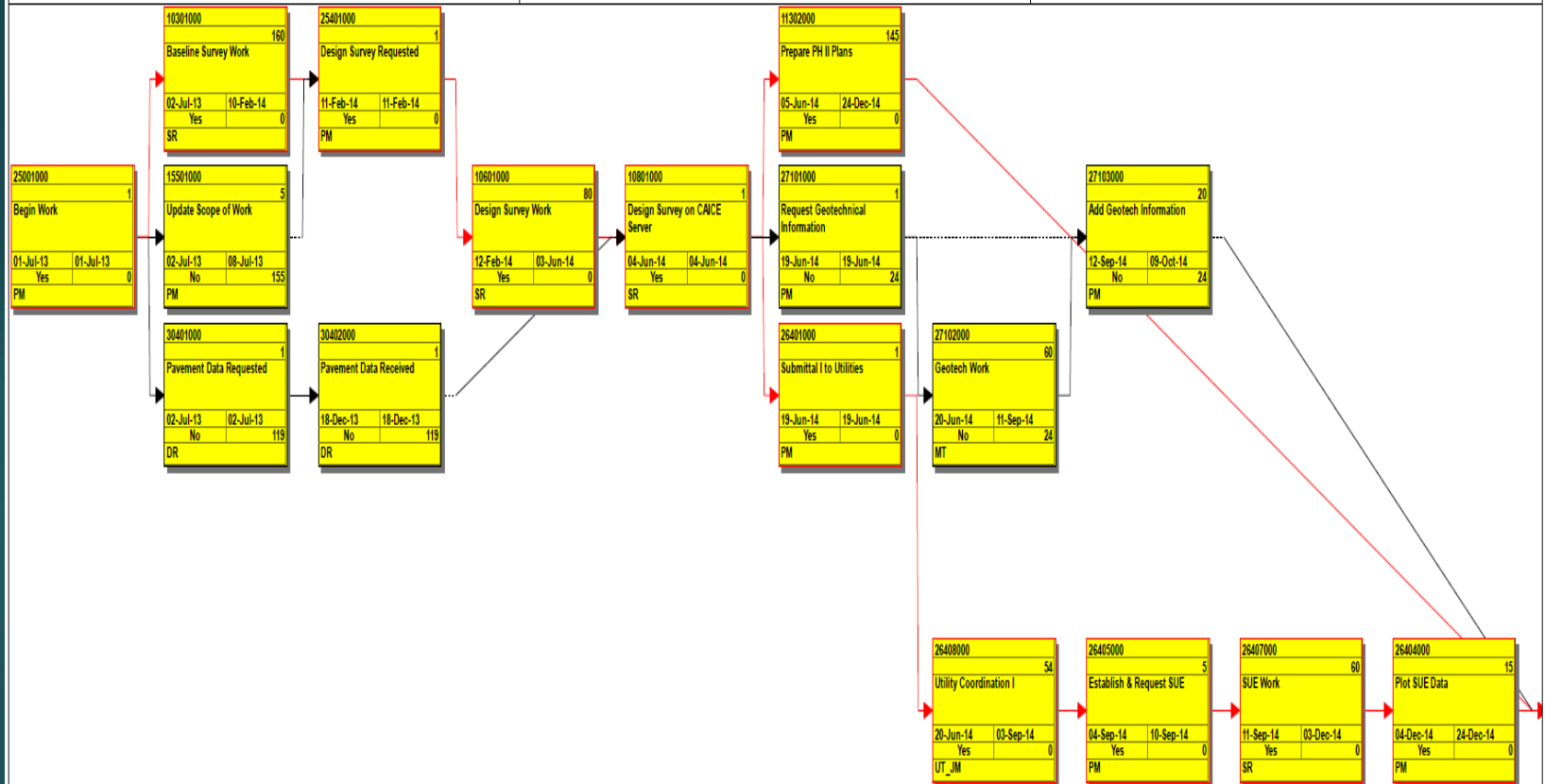
# 3R Logic Template cont.
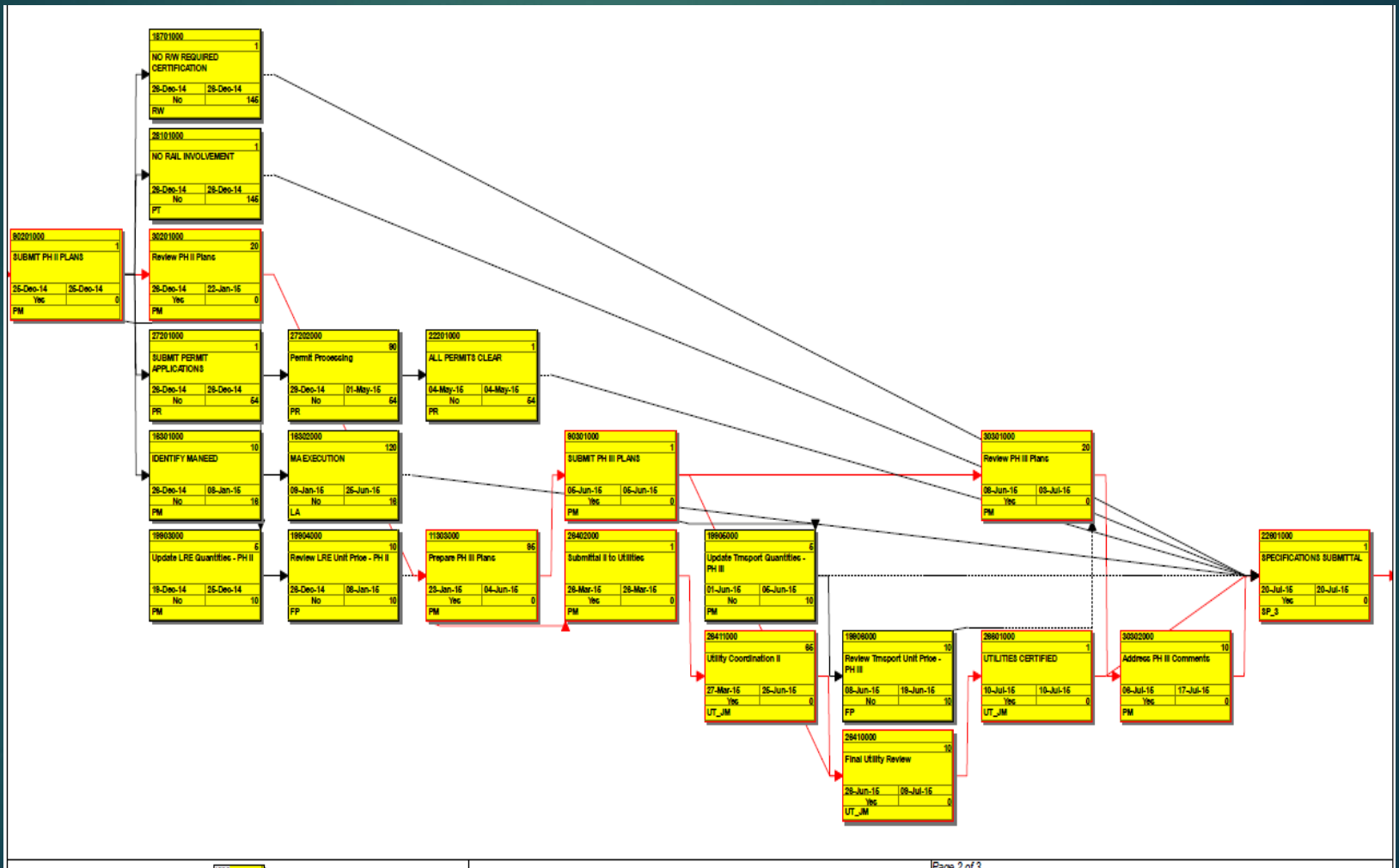
# What is the Critical Path?

- The critical path is the **<u>longest path</u>** of activities to the end of the project

- Activity delays on the critical path directly impact the project completion date by lengthening the total project duration

- Examples of critical activities *can* include:

  - Plans Preparation

  - Utility Certification

  - Documents to R/W

  - R/W Certification

  - Letting Date

# Critical Path Example

| Activity Name | Start | Finish | Late Start | Late Finish | Total Float |
|---|---|---|---|---|---|
| Review LRE Unit Price - PH II | 27-Feb-15 | 12-Mar-15 | 13-Mar-15 | 26-Mar-15 | 10 |
| Review PH II Plans | 27-Feb-15 | 26-Mar-15 | 27-Feb-15 | 26-Mar-15 | 0 |
| IDENTIFY MA NEED | 27-Feb-15 | 12-Mar-15 | 23-Mar-15 | 03-Apr-15 | 16 |
| SUBMIT PERMIT APPLICATIONS | 27-Feb-15 | 27-Feb-15 | 14-May-15 | 14-May-15 | 54 |
| Submittal II to Utilities | 28-May-15 | 28-May-15 | 28-May-15 | 28-May-15 | 0 |
| Prepare PH III Plans | 27-Mar-15 | 06-Aug-15 | 27-Mar-15 | 06-Aug-15 | 0 |
| SUBMIT PH III PLANS | 07-Aug-15 | 07-Aug-15 | 07-Aug-15 | 07-Aug-15 | 0 |
| Update Trnsport Quantities - PH III | 03-Aug-15 | 07-Aug-15 | 17-Aug-15 | 21-Aug-15 | 10 |
| Utility Coordination II | 29-May-15 | 27-Aug-15 | 29-May-15 | 27-Aug-15 | 0 |
| Review Trnsport Unit Price - PH III | 10-Aug-15 | 21-Aug-15 | 24-Aug-15 | 04-Sep-15 | 10 |
| Review PH III Plans | 10-Aug-15 | 04-Sep-15 | 10-Aug-15 | 04-Sep-15 | 0 |
| Final Utility Review | 28-Aug-15 | 10-Sep-15 | 28-Aug-15 | 10-Sep-15 | 0 |
| UTILITIES CERTIFIED | 11-Sep-15 | 11-Sep-15 | 11-Sep-15 | 11-Sep-15 | 0 |
| Permit Processing | 02-Mar-15 | 03-Jul-15 | 15-May-15 | 17-Sep-15 | 54 |
| Address PH III Comments | 07-Sep-15 | 18-Sep-15 | 07-Sep-15 | 18-Sep-15 | 0 |
| MA EXECUTION | 13-Mar-15 | 27-Aug-15 | 06-Apr-15 | 18-Sep-15 | 16 |
| ALL PERMITS CLEAR | 06-Jul-15 | 06-Jul-15 | 18-Sep-15 | 18-Sep-15 | 54 |
| NO R/W REQUIRED CERTIFICATION | 27-Feb-15 | 27-Feb-15 | 18-Sep-15 | 18-Sep-15 | 145 |
| NO RAIL INVOLVEMENT | 27-Feb-15 | 27-Feb-15 | 18-Sep-15 | 18-Sep-15 | 145 |
| SPECIFICATIONS SUBMITTAL | 21-Sep-15* | 21-Sep-15 | 21-Sep-15 | 21-Sep-15 | 0 |
| Specs Submittal Review | 22-Sep-15 | 09-Oct-15 | 22-Sep-15 | 09-Oct-15 | 0 |
| CD Submittal Due to Specs | 12-Oct-15 | 12-Oct-15 | 12-Oct-15 | 12-Oct-15 | 0 |
| CD Submittal Review | 12-Oct-15 | 29-Oct-15 | 12-Oct-15 | 29-Oct-15 | 0 |
| PRODUCTION DATE | 30-Oct-15 | 30-Oct-15 | 30-Oct-15 | 30-Oct-15 | 0 |
| Mail Date (PS&E) | 09-Nov-15 | 09-Nov-15 | 09-Nov-15 | 09-Nov-15 | 0 |
| LETTING DATE | 20-Jan-16 | 20-Jan-16* | 20-Jan-16 | 20-Jan-16 | 0 |

□ This project's critical path is identified by the red bars
  □ *Path includes plans, utilities, plans processing, letting date*
□ Total float for the critical path = 0

# Schedule Updating

- Who has heard of PSEE?

- Anybody ever get a negative float report?

- Schedules should be updated **at least** monthly through PSEE

- Why do those dates move around?

- Garbage in, garbage out!  Schedules should always reflect the current status of a project

# Getting Back on Schedule

How can a project get back on schedule if it falls behind (negative float)?

- ► Change the scope of work by removing tasks
    - ► For example, eliminating a phase submittal
- ► Decrease the duration of remaining activities
    - ► For example, reduce review time for plans
- ► Move out the end date / constraint of the project

# Lessons Learned…

- Early and often
- *Activities outside of your control*
  - *Geotech*
  - *Utilties*
  - *Right of Way*
- *Early identification of work*

# Most Important Thing To Remember About Schedules........